Bulletin 537

GROWING CORN IN OHIO IN 1971

COOPERATIVE EXTENSION SERVICE
THE OHIO STATE UNIVERSITY

FIG. 1—Distribution of Southern Corn Leaf Blight in Ohio and Estimated Severity in 1970

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SOUTHERN CORN LEAF BLIGHT

Southern Corn Leaf Blight is a disease caused by the fungus, *Helminthosporium maydis*. It affects sweet corn, popcorn, and field corn. The disease has been known in Ohio for many years, but it did not cause economic loss in the state until 1970 when about 10 percent of the crop was lost (Figure 1).

The sudden appearance of the disease in 1970 in epidemic proportions was due to (1) the presence of a new strain or race of the causal fungus, (2) the widespread use of corn hybrids that contain the Texas source of male sterility (Tms), and (3) favorable weather conditions for the growth, reproduction, and spread of the fungus.

The new strain, called the "T" race, became widespread on corn in the southern states early in the 1970 season. The microscopic spores, which develop rapidly and in tremendous numbers on the diseased leaves, were blown northward. This established the disease in Ohio by mid-July.

Temperatures around 80° F. combined with high humidity and moisture from frequent rains and heavy dews provided favorable weather conditions for the disease to develop rapidly. Most of the corn in Ohio was susceptible, since it is estimated that the Tms type of cytoplasm was present in 70 to 80 percent of the corn in the state. The new T race of the pathogen is very virulent on corn with this type of cytoplasm, while corn with normal cytoplasm is quite resistant to attack by this new race.

Leaf blight and ear rot are the principal phases of the disease. When leaf blight is severe and develops early, the ears are small and chaffy. A gray to black ear and cob rot may occur, resulting in additional loss. Leaves killed early result in increased susceptibility to stalk rot caused by *Diplodia* and *Fusarium*. The stalk breakage and lodging, which result from stalk rot, cause further losses and complicate harvesting.

There is no way to predict how severe the disease will be in Ohio in 1971. Weather conditions in Ohio and in the South will influence strongly the incidence of the disease. If the fungus survives in last season's corn crop residues until April and May, it is possible that the disease will appear earlier than it did in 1970. Since the disease was epidemic in Ohio for the first time in 1970, we do not yet know if there will be any survival through the winter. Also, the fungus can be carried in the seed and, even in the absence of overwintering in the field, seedlings growing from infected seeds might provide a source of inoculum (spores of the fungus) early in the season. Even so, it is possible that weather conditions early in the growing season will suppress disease development until later in the season. Seed treatment will not eradicate the fungus that may be within the seed.

The inoculum is spread long distances by wind, and locally within fields by wind and rain.

It doesn't appear likely that any one special cultural practice will help control the disease. Clean plowing in fall or winter probably will not be beneficial, since it is impossible to destroy crop residues in fence rows or other places where it cannot be plowed down. Follow cultural practices that are ordinarily recommended for maximum production.

This disease will be controlled in the future through the use of resistant hybrids. Resistant hybrids will be (1) those containing normal cytoplasm, (2) hybrids with the Tms type of cytoplasm with genetic factors added to make them resistant, and (3) hybrids developed by incorporating new types of cytoplasmic factors which do not condition susceptibility to *Helminthosporium maydis.* Some seed of hybrids with normal cytoplasm is available now, and considerable quantity of such seed will be available for 1972 planting. Several years will be necessary to develop hybrids of the other two types.

FARM MANAGEMENT DECISIONS

Timeliness in farming has always been one of the important keys to profit, but it will be even more important this year to protect as much as possible against reduced income caused by corn blight. Be sure to order desired seed corn varieties and other needed spring seeds early and plan to plant corn as early as weather permits. Blight-resistant seed corn is in short supply, so contact your seed supplier *now* if you have not already ordered your seed.

Planting early has at least three advantages: (1) early planted corn runs the chance of being well along in maturity before the blight hits, (2) if poor germination or seedling blight damage occurs, you have time to seed to soybeans or another crop substitute, (3) even with the seeding of all blight-resistant (normal N-cytoplasm seed), early planting has yield advantages over late planted corn.

In addition to emphasizing timeliness, consider these suggestions in making decisions for your farm in 1971:

1. If you can get all N-cytoplasm seed corn, plant all available land to corn to sell at a high price if heavy blight strikes. It will still be profitable if there is no blight in 1971. (Reduce seeding rate of N-cytoplasm from maximum population to extend advantage of blight-resistant seed to more acres.)

2. Soybeans will be the key alternative crop, with grain sorghum or oats as a weak consideration in most cases.

3. When using a blend of normal and TMS seed corn, be sure to use on the corn pre-emergent weed killers that will *not* damage soybeans in case corn has to be disced up and seeded to soybeans. Also, if corn seed other than blight-resistant seed is planted, the extra nitrogen fertilizer application may need to be delayed for side dressing after corn stand and other signs of a good crop are in evidence, instead of pre-plant application. You cannot afford to skimp on starter fertilizer.

4. Before considering grain sorghum seriously, be sure you have the equipment to plant, harvest, dry, and store properly plus an available market. If you feed it, your market question is solved.

5. A livestock farmer can assume higher prices for feed grains. Prices may vary between types of grains; therefore, it will be important to watch for price change and be willing to substitute to maintain the lowest cost rations.

The purpose of the following budgets is to help evaluate, from a farm management standpoint, the alternatives to growing corn. The profitability of alternative crops are compared to corn, assuming three levels of blight damage. Each individual farmer may want to use his own estimates of yields, costs, and prices. Table 1 compares the alternatives assuming 120-bushel corn yields for blight-resistant seed and Table 2 compares alternatives to 100-bushel corn yield using blight-resistant seed.

Table 1. EVALUATING CROP PRODUCTION ALTERNATIVES FOR 1971 (assuming 120 bu. corn yields)

	Normal Cytoplasm Seed	Blend of Normal and Tms Seed	Tms Cytoplasm Seed	Single X F-2 Normal Cytoplasm Seed	Soybeans	Grain Sorghum	Oats
NO BLIGHT DAMAGE							
Yield	120 bu	120 bu	120 bu	85 bu	40 bu	56 cwt	80 bu
Price per unit	$ 1.20	$ 1.20	$ 1.20	$ 1.20	$ 2.70	$ 1.65	$ .65
Gross returns per acre	$144.00	$144.00	$144.00	$102.00	$108.00	$ 92.40	$ 52.00
*Variable cost per acre	$ 54.60	$ 53.60	$ 51.60	$ 48.80	$ 28.80	$ 45.60	$ 19.60
**Net return over V.C.	$ 89.40	$ 90.40	$ 92.40	$ 53.20	$ 79.20	$ 46.80	$ 32.40
MODERATE BLIGHT DAMAGE							
Yield	120 bu	105 bu	90 bu	85 bu	40 bu	56 cwt	80 bu
Price per unit	$ 1.40	$ 1.40	$ 1.40	$ 1.40	$ 2.70	$ 2.00	$ .80
Gross returns per acre	$168.00	$147.00	$126.00	$119.00	$108.00	$112.00	$ 64.00
*Variable costs per acre	$ 54.60	$ 52.40	$ 50.20	$ 48.80	$ 28.80	$ 45.60	$ 19.60
**Net return over V.C.	$113.40	$ 84.60	$ 65.80	$ 70.20	$ 79.20	$ 66.40	$ 44.40
SEVERE BLIGHT DAMAGE							
Yield	120 bu	75 bu	30 bu	85 bu	40 bu	56 cwt	80 bu
Price per unit	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 2.70	$ 2.35	$ .92
Gross returns per acre	$192.00	$120.00	$ 48.00	$136.00	$108.00	$131.60	$ 73.60
*Variable costs per acre	$ 54.60	$ 50.00	$ 44.40	$ 48.80	$ 28.80	$ 45.60	$ 19.60
**Net return over V.C.	$137.40	$ 70.00	$ 3.60	$ 87.20	$ 79.20	$ 86.00	$ 54.00

* Variable Costs include cash costs of seed, fertilizer, fuel, labor, machinery, etc.
** Net return over Variable Costs would be the returns to fixed costs in land, machinery, buildings and to management.

Table 2. EVALUATING CROP PRODUCTION ALTERNATIVES FOR 1971 (assuming 100 bu. corn yields)

	Normal Cytoplasm Seed	Blend of Normal and Tms Seed	Tms Cytoplasm Seed	Single X F-2 Normal Cytoplasm Seed	Soybeans	Grain Sorghum	Oats
NO BLIGHT DAMAGE							
Yield	100 bu	100 bu	100 bu	70 bu	33 bu	45 cwt	65 bu
Price per unit	$ 1.20	$ 1.20	$ 1.20	$ 1.20	$ 2.70	$ 1.65	$ .65
Gross returns per acre	$120.00	$120.00	$120.00	$ 84.00	$ 89.10	$ 74.25	$ 42.25
*Variable cost per acre	$ 54.60	$ 53.60	$ 51.60	$ 48.80	$ 28.80	$ 45.60	$ 19.60
**Net return	$ 65.40	$ 66.40	$ 68.40	$ 35.20	$ 60.30	$ 28.65	$ 22.65
MODERATE BLIGHT DAMAGE							
Yield	100 bu	85 bu	70 bu	70 bu	33 bu	45 cwt	65 bu
Price per unit	$ 1.40	$ 1.40	$ 1.40	$ 1.40	$ 2.70	$ 2.00	$ .80
Gross returns per acre	$140.00	$119.00	$ 98.00	$ 98.00	$ 89.10	$ 90.00	$ 52.00
*Variable costs per acre	$ 54.60	$ 52.40	$ 50.20	$ 48.80	$ 28.80	$ 45.60	$ 19.60
**Net return	$ 85.40	$ 66.60	$ 47.80	$ 49.20	$ 60.30	$ 44.40	$ 32.40
SEVERE BLIGHT DAMAGE							
Yield	100 bu	60 bu	30 bu	70 bu	33 bu	45 cwt	65 bu
Price per unit	$ 1.60	$ 1.60	$ 1.60	$ 1.60	$ 2.70	$ 2.35	$ .92
Gross returns per acre	$160.00	$ 96.00	$ 48.00	$112.00	$ 89.10	$105.75	$ 59.80
*Variable costs per acre	$ 54.60	$ 50.00	$ 44.40	$ 48.80	$ 28.80	$ 45.60	$ 19.60
**Net return	$105.40	$ 46.00	$ 3.60	$ 63.20	$ 60.30	$ 60.15	$ 40.20

* Variable Costs include cash costs of seed, fertilizer, fuel, labor, machinery, etc.
** Net return over Variable Costs would be the returns to fixed costs in land, machinery, buildings and to management.

SEED CORN SUPPLY FOR 1971

(Based on USDA Release of November 19, 1970)

Officials in the USDA, the American Seed Trade Association, and the seed corn companies have made intensive surveys of their expected 1971 seed corn supply. The best estimate of the total supply for the U.S. is that there will be just enough seed to plant the 1971 acreage—if most available seed is used.

With the estimated 1971 supply at 18,249 million bushels, and 16,424 million bushels required for planting, this would reduce the in-channel seed supply to about 10 percent for 1971. (See Table 3 for estimated 1971 U.S. seed corn supply.)

The seed estimate in the column "+20% for Smaller Growers" (Table 3) was assumed and not confirmed. With most of this seed being on "T" cytoplasm and most produced in areas affected by the blight, some may not be of adequate quality to market. Thus, the seed supply could be overestimated.

Table 3. SEED CORN SUPPLY FOR 1971 BASED ON USDA RELEASE OF NOVEMBER 19, 1970

This Portion of Report Taken from USDA Release of November 19, 1970	Expected Seed Corn Supply (80%) for 1971 Seeding by Method of Hybridization				+20% for Smaller Growers
Maturity Zone	N-Cytoplasm	T-Cytoplasm	Blend	Total	
	1,000 lbs.				(Bushels) 1,000 lbs.
DEEP SOUTH					
Georgia, Alabama, Louisiana, Mississippi, Florida, East Texas	25,320	5,095	4,811	35,226	790 44,032
MID-SOUTH Missouri, Kentucky, Tennessee, Virginia, North Carolina, South Carolina (Arkansas, Delaware, Maryland, West Virginia)	23,158	17,828	49,488	90,474	2020 113,092
EASTERN					
Pennsylvania, New York, New England (New Jersey)	5,144	11,241	19,537	35,922	808 44,902
EASTERN AND CENTRAL CORN BELT					
Illinois, Indiana, Ohio, Eastern-Central Iowa	94,308	105,823	152,718	352,849	7875 441,061
WESTERN CORN BELT Western Iowa, Nebraska, Kansas, South Dakota (Colorado, Montana, Wyoming, Oklahoma, New Mexico, West Texas)	9,993	119,893	44,287	174,173	3890 217,716
NORTHERN STATES					
Michigan, Minnesota, Wisconsin, North Dakota	25,543	66,871	36,520	128,934	2874 161,167
OTHER (remaining states)					
TOTAL	183,466	326,751	307,361	817,578	(18,249) 1,021,970

LABEL TO TELL BLIGHT RESISTANCE

Notice that in Table 3 the 1971 seed corn supply is listed in thousands of pounds of N-Cytoplasm, T-Cytoplasm, and Blend by regions of the U.S. Corn hybrid susceptibility to the new race of Southern Corn Leaf Blight is closely related to hybrids with Texas male-sterile (Tms) cytoplasm. In general, hybrids with normal cytoplasm show the most resistance. Blend hybrids are a blend of normal and Tms cytoplasm types. Seed corn companies plan to label seed corn in 1971 with a "T" (Texas male-sterile cytoplasm), "B" (Blend of Texas male-sterile cytoplasm and normal cytoplasm, and percent of each), and "N" (normal cytoplasm). In general, hybrids most resistant to the new race of Southern Corn Leaf Blight will be labeled "N." The "N" label, then, will be first choice as the most resistant, "B" the second choice, and "T" the third choice.

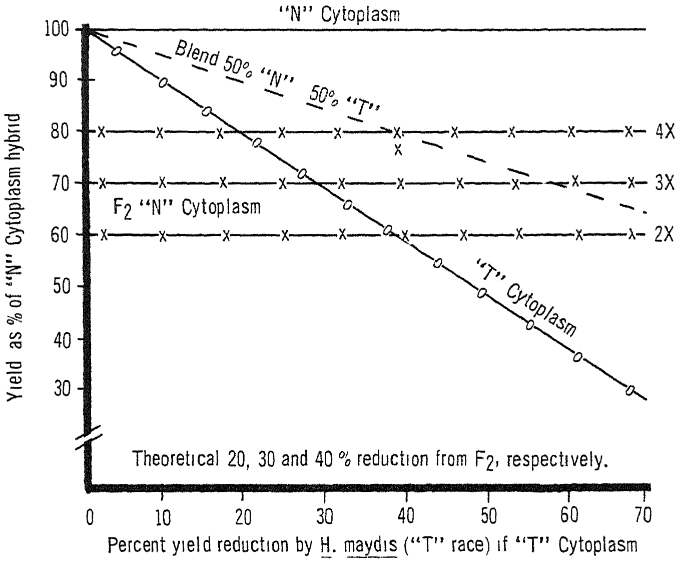
However, some inbred combinations in normal cytoplasm are quite susceptible, and some inbred combinations with Tms show a fair degree of tolerance. The seed dealer is the best source of information regarding degree of resistance in T hybrids or susceptibility of N hybrids if they are exceptions.

In areas of Ohio where yield reduction was most severe in 1970, seed dealers have been offering some normal cytoplasm F_2 of a single-cross hybrid to farmers. Also, some normal cytoplasm Argentine Flint Corn will be available in southern Ohio to be used for silage only.

Based on information in Table 3, the eastern and central Corn Belt will have 21.4 percent of corn seed on normal cytoplasm (N), 35.6 percent of blend (B), and 44.0 percent on Tms cytoplasm (T). The percent of the various types of seed should be about the same for Ohio. In 1971 most companies will be shifting the normal cytoplasm (N) and blend (B) hybrids to those areas of Ohio that were most seriously affected by the blight in 1970.

As a further guide to seed corn selection, Figure 2 graphically illustrates the theoretical yields of N, B, and T hybrids with normal cytoplasm F_2 of double crosses (4X), special crosses (3X), and single crosses (2X) at varying yield reduction from *H. maydis* (T race) in a T cytoplasm hybrid.

Assumptions made in regard to Figure 2 are (1) normal cytoplasm corn is not affected by the blight, (2) F_2 generation of a four-way normal cytoplasm hybrid will reduce yield 20 percent, (3) F_2 generation of a three-way normal cytoplasm hybrid will reduce yield 30 percent, (4) F_2 generation of a two-way (single cross) normal cytoplasm will reduce yield 40 percent, and (5) all F_2 hybrids were harvested, properly stored, and processed for seed. Assuming the same degree of infestation with *H. maydis* (T race), the yield loss from the blend will be half that of the T-cytoplasm hybrid.



From DeKalb Agresearch, Inc. "Southern Corn Leaf Blight Report"

FIG. 2—Theoretical Yield Expectations of a Hybrid with Varying Proportions of "T" Cytoplasm and F_2 (second generation) from this Hybrid with "N" Cytoplasm at Various Levels of Infection with H. maydis ("T" race)

Figure 2 illustrates why agronomists have cautioned farmers since the introduction of hybrid corn not to save F_2 generation seed from corn hybrids. Farmer experience in 1970 should be a good guide to selection of corn for 1971. Agronomists in Ohio are assuming that the *H. maydis* strain of Southern Corn Leaf Blight will be present in 1971 in about the same degree of infestation as it was in 1970. Based on this assumption, there are areas in Ohio were F_2 seed will be justified if N or B cytoplasm seed are not available.

ALTERNATIVE AGRONOMIC FEED AND CASH CROPS

(As Substitutes for Corn)

There may be situations in Ohio in 1971 in which the producer is located in an area where corn yields were severely reduced by Southern Corn Leaf Blight, and T cytoplasm is the only seed available for corn production on part of the acreage. In such cases, it may be advisable to consider substitutes.

Crops considered as substitutes to corn as animal feeds are grain sorghum, spring barley, oats, spelt, and triticale. The main cash crop as a substitute to corn is soybeans.

GRAIN SORGHUM

Bird-resistant grain sorghum appears to be the best feed grain substitute for corn, based on feed produced per acre. Research at the Ohio Agricultural Research and Development Center on grain sorghum began in 1966 because it was thought that bird-resistant sorghum hybrids might be an alternate feed grain crop to replace corn in areas where corn was being heavily damaged by red-winged blackbirds and associated species. Research at OARDC and branch stations has included variety trials, seeding rates, date of planting, row width, and weed control. Results of research were published in 1970 in Research Circular 182 entitled, *Bird-Resistant Grain Sorghum, a New Crop for Ohio,* by Merle H. Niehaus and Walter H. Schmidt. Growers interested in producing grain sorghum may obtain a copy of this bulletin from their county Extension Service office.

Some important points for grain sorghum production are:

1. Fertilize according to grain-yield goals, with fertility programs and expected yield similar to corn.

2. Prepare conventional row-crop seedbed.

3. Use recommended herbicides and methods of application for weed control. (See *1970-71 Ohio Agronomy Guide,* Page 81.)

4. Use a corn planter equipped with sorghum plates set to plant approximately 12 pounds per acre.

5. Plant in the last 2 weeks of May in 30-inch rows.

6. No insect or disease treatment is recommended on a general basis. Severe corn leaf aphid infestations may develop, and these should be controlled.

7. A special trial planted near the Ohio River indicated that all of the bird-resistant grain sorghums which have been tested are susceptible to maize dwarf-mosaic virus (MDMV).

8. Grain should be artificially dried and will require some processing such as rolling or grinding for improved efficiency in feeding.

9. Grain sorghum may be substituted for feed grain but not for cash crop income. Generally, elevators are not equipped for handling grain sorghum unless prior arrangements are made.

SPELT

Spelt is a type of wheat that is not considered in the official grain standards. In areas where winter wheat safely survives the winter, winter spelt also can be grown.

Data obtained over the last three years (Table 4) show that fewer pounds of spelt are produced per acre than barley or wheat. According to the data in Table 4, spelt lodges more, matures later than wheat or barley, and is less winter hardy than wheat. The threshed spelt contains about 20 to 30 percent of its total weight in hulls or chaff, and that should be considered when comparing yields directly with wheat or barley that thresh free from chaff.

Culture is the same as for wheat except that the seeding rate for spelt is 8 to 12 pecks. Spelt, barley, and triticale are not counted against the feed grain or wheat allotment for 1971.

Table 4. RESULTS OF YIELD TRIALS INCLUDING SPELT, WHEAT, AND BARLEY, 1968, 1969, AND 1970 AT THE OHIO AGRICULTURAL RESEARCH AND DEVELOPMENT CENTER, WOOSTER, OHIO

Crop or Variety	Yield lbs/Acre	Lodging	Maturity	Winter Survival
1968 only—5% LSD = 516 lbs/acre				
		%	Date Ripe	%
Redcoat Wheat	2472	0	7-18	94
Harrison Barley	3114	0	7-19	56
Common Spelt	2142	12	7-26	80
1969 only—5% LSD = 660 lbs/acre				
		1-10 Scale	Date Headed	
Logan Wheat	3570	4*	5-30	98
Reed Wheat	3072	4	6-1	90
Seneca Wheat	3096	5	5-30	98
Common Spelt	2676	6	6-10	50
1970 only—5% LSD = 246 lbs/acre				
		1-10 Scale	Date Headed	
Logan Wheat	2916	2*	5-29	100
Reed Wheat	2652	2	5-30	99
Seneca Wheat	2364	4	5-30	100
Common Spelt	2004	6	6-6	91

* 1 = erect to 10 = lodged

1968—Seeding date—10/13/67; Seeding rate—wheat—8 pecks/acre, barley—9 pecks/acre, spelt—10 pecks/acre, Fertilizer applied—7.5-30-30/acre; Plot size 4' x 146'; Design—Randomized complete block, 4 replications.

1969—Seeding date—9/26/68; Seeding rate—wheat—8 pecks/acre; spelt—10 pecks/acre, Fertilizer applied—12.5-50-50/acre; Plot size—4' x 109'; Design—Randomized complete block, 2 replications.

1970—Seeding date—9/26/69; Seeding rate—wheat—8 pecks/acre; spelt—10 pecks/acre, Fertilizer applied—15-60-60 plus 30 lbs/acre of N on 3/16/70; Plot size—4' x 114'; Design—Randomized complete block, 2 replications.

TRITICALE

Triticale is a man-made species resulting from a cross between wheat *(triticum)* and rye *(secale)*. Hybrids between rye and wheat date back to 1875, but intensive work was started in North America at the University of Manitoba about 10 years ago. Both winter and spring types were developed.

Varieties available tend to have sterility problems which lead to susceptibility to ergot. Yield trials in North Dakota, Minnesota, and Winnipeg, Canada, indicate triticale yields about the same or lower than other small grains.

Based on the limited Ohio research and information from several states on the yield and ergot problem associated with triticale, agronomists recommend that triticale not be grown in Ohio in 1971. Research underway at OARDC on triticale may change the above recommendation for future years.

Triticale Culture

Seeding rate—100 pounds of viable seed. Triticale often has low germination (70%), so adjust seeding rate accordingly.

Seeding date—Mid-October for fall types; early to mid-April for spring types.

Fertility—Even higher than other small grains which require a very high fertility.

SOYBEANS

Soybeans as an alternate crop to replace corn in the severely or moderately infected blight areas is a good choice when considering the relative net returns. (See Tables 1 and 2.)

There are a number of adaptable soybean varieties that are high yielding under good management practices. Refer to the *1970-71 Ohio Agronomy Guide,* Pages 57 and 58, or Ohio Research Circular *Ohio Soybean Performance Trials*

—*1970* that will soon be available at the county Extension Service office.

For high yields and economic production, early planting (May 1 to 15), has been shown to be the management practice contributing most toward obtaining high yields. Selection of a certified, full-season variety will contribute more to increasing yields than an earlier-maturing variety. Soils that are dark colored, well-drained, or moderately well-drained contribute more to efficient production than light colored soils, drouthy soils, or poorly drained soils.

Fertilizer application at planting time on soybeans has not shown the yield response that can be expected on corn. However, soybeans do respond to high-fertility soils where fertilizers have been applied generously in the past. Recent research in a neighboring state has shown good yield increases with 40 to 60 pounds of potassium side-placed at planting time even at high-potassium fertility. This practice is currently being checked in Ohio. A fertilizer application of 200 pounds of 5-10-20 or 5-10-30 could be profitable under certain environmental conditions.

Uniform planting depth of not more than 1½ inches is important for uniform emergence. Planting rates of 6 to 8 beans per foot of row on high-germinating seed is recommended. *Read the tag* for percent germination, and adjust planting rate accordingly.

Certified soybean seed may be in short supply because of increased acres that may be planted. Order and accept delivery early. If you plant your own soybeans from a source **not certified, CHECK THE GERMINATION.** For some unknown reason, the germination of some soybeans is lower than normal this year.

OATS AND SPRING BARLEY

Spring-seeded small grain may be substituted for corn on farms where feed grains are needed. Before choosing a substitute crop for T or B hybrids, review Tables 1 and 2 to compare the net return for fixed changes of producing T hybrids with the substitute crop of small grains, soybeans, and grain sorghum.

The yield of spring barley will be more erratic than oats, due mainly to timeliness of planting and the sensitivity of barley to wet, cool weather conditions.

The planting date, seeding rate, and weed control practices for oats and spring barley are essentially the same. For these recommendations, as well as varieties to use, refer to pages 60 and 61, and Table 104 of the *1970-71 Ohio Agronomy Guide*.

Profitable production and high yields are necessary to obtain a high net return for the fixed production costs. The application of fertilizer, based on soil tests, is a must for oats and spring barley. Many producers are afraid to use nitrogen on oats because of lodging. Research has proved that nitrogen applied at seeding time is profitable when kept in balance with phosphorus and potassium. Selection of the stiff-strawed varieties is important when nitrogen is applied. Refer to Tables 52, 53, and 54 of the *1970-71 Ohio Agronomy Guide* if recent Ohio State University soil test results are available.

FEED GRAIN PROGRAM ALTERNATIVE

The three-year feed grain set-aside program provided for in the Agricultural Act of 1970 gives an alternative to some corn growers. Participation is based on sign-up between March 1 and April 9, 1971 at county A.S.C.S. offices.

The program requires that a producer set aside no more than 20 percent of his feed grain (corn and sorghum) base for conserving use, that he maintain the normal conserving base acres as in past years, and that he comply with his tobacco allotment and other program requirements.

By participating in the program, a producer will become eligible for a corn loan based on $1.08 support on all his corn produced, and a support payment at a minimum of 32 cents per bushel for the normal yields on half the corn base.

Farmers who plant less than 45 percent of their 1971 corn base will have their 1972 feed grain base reduced by the underplanting, up to 20 percent. If no feed grains are planted for three years, the base is lost and is re-allocated.

For example, a farmer participating in the program has a feed grain base of 100 acres and a conserving base of 20 acres. He will need to set aside 20 acres to a conserving use in addition to the conserving base. He then can plant any amount of corn he wishes.

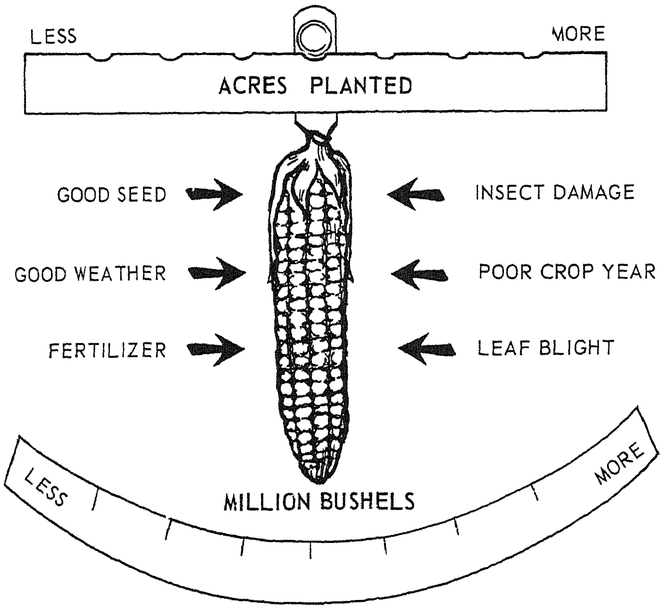
If blight is a problem, he may choose to plant only 45 acres of corn to protect his feed grain base. The remaining 35 acres can be planted to soybeans or other crops. He will collect a support payment of $1,350 assuming a farm yield of 90 bushels per acre. (Half of feed grain base [50 A] times the farm yield [90 bu.] times the payment per bushel [32¢].)

He still may collect the price-support payment and plant no corn, but unless a substitute crop such as wheat is used, the farm feed grain base will be reduced in the 1972 crop year. Soybeans under present regulations will not protect the feed grain base. Wheat acreage in excess of the domestic wheat allotment may be substituted for feed grain to protect the feed grain base.

FEEDSTUFFS NEEDED: ACREAGE REQUIRED

With corn leaf blight a threat to the 1971 corn crop, and with a rapidly shrinking carryover of soybeans, major emphasis needs to be directed toward soybeans and the feed grains, mainly corn.

In view of this situation, some targets need be established to guide the production of feed stuffs required of U.S. agriculture. Production targets are something to shoot at but are rarely hit with precision, since a large number of forces are at work and millions of individual decisions are involved. The future is never certain because all factors are not fully predictable. Nowhere is this more true than in agriculture, which is so highly dependent on nature and many independent decision makers.



OUTPUT

FIG. 3—Corn Crop Pendulum

We probably will have sufficient corn and other feed grains for the nation's livestock. We have a "safety valve" in adequate wheat supplies. Soybeans become important because of soybean meal needs and as a substitute crop to corn. And we have more than adequate land available to plant the 16 million more acres of corn and soybeans which may be needed.

CORN

Needs for the 1971-72 Market Year

Industrial uses of corn in 1971-72 are expected to remain near 400 million bushels. However, with higher corn prices, major adjustments are already occurring in the livestock industry. For the 1971-72 market year there may be about 3 percent fewer animal units than in 1970. Hogs and fed cattle are both expected to be marketed at lighter weights, thus conserving the feed supply. Consequently, total corn use in the domestic market was estimated to be 5 or 6 percent below the quantity used in 1969-70 (Table 5). We assume exports will decline as importers look to alternate suppliers for feed grains. Use of corn in the combined domestic and foreign market may be near 4,200 to 4,300 million bushels in the 1971-72 market year.

Output—Some Potentials

The corn acreage in 1971 will depend mainly on the availability of seed corn, participation in the feed grain program, shifting from corn to other crops in blight-affected areas, shifting to more corn in areas not affected by blight, weather at planting time, livestock needs, and the financial situation. The key issue is the amount of risk that an individual farmer wants to assume.

Table 5. CORN SUPPLIES AND USE IN U.S.

Item	1969-70	1970-71[a]	1971-72[a]
	(Million Bushels)		
Supply			
Carryover	1,113	999	630
Output	4,579	4,110	3,700-4,500[b]
Total	5,692	5,109	4,330-5,130
Use			
Domestic	4,077	3,955	3,830
Export	616	525	400
Total	4,693	4,480	4,230
Carryover	999	629	100-900

[a] Estimated.
[b] Range reflects a 10 percent change in either direction from 1970 output.

Estimating 1971 corn output is risky business. Yields of corn will be influenced by the incidence of blight, weather conditions, disease or insect problems, and cultural practices. Corn output in 1971 may vary 10 percent in either direction from the 1970 output of 4,110 million bushels. This would mean a corn crop in 1971 ranging from 3,700 to 4,500 million bushels.

The optimistic estimate of 4,500 million bushels could result from a return to normal growing conditions throughout the Corn Belt. Under these circumstances, and with a 625-million bushel carryover on October 1, 1971, our total corn supplies would be 5,125 million bushels, or about the same as was available in 1970-71. The carryover of corn on October 1, 1972 would be near 900 million bushels—neither burdensome nor critical. Corn prices in this case could be expected to remain near current levels.

The pessimistic estimate of 3,700 million bushels could arise from less acreage being planted to corn in 1971, widespread drouth, or more corn leaf blight than occurred in 1970. In this case the carryover of corn on October 1, 1972 would be extremely short. If this materializes, both exports and domestic use probably would be curtailed below that indicated in Table 5, and corn prices would increase above 1970-71 levels. With this estimate, the amount of wheat used for feed would be much greater and at higher prices than exist in 1970-71.

Acreage Needs

A 1971 corn crop of 4,500 million bushels seems to be the most plausible target. This is 10 percent more than the 4,110 million bushels harvested in 1970, a little smaller crop than harvested in 1969, and 5 percent smaller than the 4,760 million bushels harvested in 1967.

Yields per acre, as well as acreage harvested for grain in the U.S., become crucial variables in making this estimate. Corn yields in the U.S. for the last three years have been respectively 78, 84, and 72 bushels per acre. The acreage required to secure a 4,500-million-bushel corn crop at, for example, the 70-, 75-, and 80-bushel yield levels are 64, 60, and 56 million acres, respectively.

Acreage of corn harvested for grain was 57.4 million acres in 1970. In 1968 and 1969 harvested acreage for grain was 55.9 and 54.6 million acres, respectively. A reasonable target corn acreage to be harvested for grain in 1971 would seem to be about 60 million acres. This would be 2.6 million, or 4.7 percent, more acres of corn than were harvested for grain in 1970.

With 60 million acres of corn needed for grain, 8 or 9 million acres harvested for silage and 1 to 2 million acres abandoned, U.S. corn producers will need to plant between 69 and 71 million acres to corn next year to reach the corn targets. The total acreage planted in 1970 was 67,171,000 acres.

Corn Acreage in Ohio

In Ohio during 1970, there were 3,247,000 million acres planted to corn and another 597,000 acres to oats. This accounts for 3,840,000 acres out of a total feed-grain acreage of 3,865,000 acres. If Ohio farmers are to share proportionately in the nation's needed increase of 4.7 percent in 1971 corn acreage, they must plant about 160,000 more acres to corn. This level of increase is possible and seems more likely to occur in the northern half of the state where there were slight impacts from leaf blight.

Current corn prices are considered conducive to an increase in production by many Ohio corn producers. If producers in the southern half of Ohio shift away from corn, northern Ohio producers would need to increase corn acreage by more than 4.7 percent to achieve the target level in the state.

FEED GRAINS

Needs in 1971-72 Market Year

We estimate total U.S. needs of feed grains (corn, sorghum, oats, barley) in the 1971-72 market year to be near 167 million tons, or about 5 percent lower than the quantity used in the 1969-70 market year (Table 6). In the domestic market during the 1971-72 year, feed-grain use is expected to be near 150 million tons, or about 3 percent below the amount used in the 1969-70 market year. The amount used in feed is expected to decline due to fewer animal units and less feed per animal unit. In the domestic market, industrial and food uses are not expected to change. Exports of feed grains also are expected to decline slightly due to higher prices.

Table 6. TOTAL FEED GRAIN SUPPLIES AND USE IN U.S.
(Corn, Sorghum, Oats, and Barley)

Item	1969-70	1970-71[a]	1971-72[a]
		(Million Tons)	
Supply			
Carryover	50	48	34
Output	174	159	143-175[b]
Total	224	207[c]	177-209[c]
Use			
Domestic	155	154	150
Export	21	19	17
Total	176	173	167
Carryover	48	34	10-42

[a] Estimated.
[b] Range reflects a 10 percent change in either direction from 1970 output.
[c] Additional wheat available for feeding.

Supplies—Some Potentials

Our carryover of feed grains October 1, 1971 is expected to be 34 million, or 14 million tons below the level of stocks on October 1, 1970. Output of feed grains in the 1971 crop year is uncertain. Corn normally accounts for nearly 70 percent of the total, so acreage and yields of corn are important. Shifts between feed grain acreage and other land use also will influence total feed grain output. Assuming that U.S. feed grain output in the 1971 crop year may vary as much as 10 percent in either direction from the 1970 output, a total feed grain output ranging from 143 to 175 million tons can be predicted.

The optimistic 175-million-ton output would mean a return to normal growing conditions throughout the nation. In this case feed grain carryover might increase to about 40 to 45 million tons—not burdensome and below the 48 million tons as of October 1, 1970.

The pessimistic 143-million-ton level would mean more damage from blight and/or a poorer growing season for feed grains than occurred in 1970. In this case, carryover would be short on October 1, 1972.

Under either the optimistic or pessimistic situation, the total feed grain supplies would be sufficient to meet both the estimated domestic and export needs. In addition, there will be a large supply of wheat available for feeding purposes. Under the pessimistic condition, livestock producers likely would be using substantial amounts of wheat—much more than has been fed in recent years.

SOYBEANS

Needs for 1971-72 Market Year

Producers in corn leaf blight affected areas are expected to shift to more soybeans. Fortunately, the output and use of soybeans is such that a substantial increase in output can be absorbed at favorable prices. Use of soybeans has exceeded output the last two years, but carryover stocks will not permit such use another year.

Continued increases in domestic use of soybean meal and oil are anticipated through the 1971-72 market year. There should be a small expansion in exports. The total increased soybean needs over the 1970-71 market year are only 80 million bushels.

Supplies—Some Potentials

For 1971 output to match the 1971-72 market year use, U.S. farmers will need to produce 1,380 million bushels of soybeans (Table 7). This is 245 million bushels, or 21 percent, more than 1970 output. If use equals expected output, carryover stocks would remain at 65 million bushels.

Table 7. SOYBEAN SUPPLIES AND USE IN U.S.

Item	1969-70	1970-71[a]	1971-72[a]
		(Million Bushels)	
Supply			
Carryover	324	230	65
Output	1,117	1,135	1,380[b]
Total	1,441	1,365	1,445
Use			
Domestic	783	850	900
Export	428	450	480
Total	1,211	1,300	1,380
Carryover	230	65	65

[a] Estimated.
[b] Output projected to meet projected use and maintain carryover at constant level.

A small increase in carryover stocks could occur, with soybean prices remaining near the 1970-71 price levels.

To produce 1,380 million bushels at the average U.S. level for the last three years of 27 bushels per acre, farmers would need to harvest about 51 million acres, or 9 million acres more than in 1970. Yields per acre in 1971 are likely to decline as producers who are unfamiliar with soybean production shift to crop land that may not be as suitable to soybeans. Assuming a 25-bushel-per-acre average yield, farmers would need to harvest about 55 million acres of soybeans. The target soybean acreage of 55 million acres represents 13 million more acres, or a 29 percent increase in acreage harvested from last year. Abandoned acreage and that harvested for hay usually totals 1 to 1.5 million acres. In this case, seeded soybean acreage in the U.S. next year will need be 56 to 57 million acres.

Soybean Acreage in Ohio

Ohio farmers planted 2,458,000 acres to soybeans in 1970. If they are to share proportionately in the U.S. increase of 30 percent in 1971 soybean acreage, they must plant about 730,000 more acres to soybeans. This level of increase is possible. Soybean acreage likely will increase in both the northern and southern part of the Corn Belt region of Ohio. In the southern half of the state, a shift of acreage can be expected from corn to soybeans and/or the feed grain program.

SOURCES OF NEEDED ACREAGE

A U.S. increase of 3 million acres in corn and 13 million acres in soybeans next year seems necessary to meet the feedstuff needs in the 1971-72 market year, assuming only minor shifts to oats and sorghums. This does not provide for a buildup of carryover stocks. Thus, prices of feed grains and soybeans should be maintained near their present relationship and level.

There is sufficient land available in the U.S. to meet the needs for 16 million more acres of soybeans and corn. Feed grain acreage set aside under government programs in recent years has been near 38 million acres. Another 5 million acres were diverted from wheat.

Source of Increased Acreage in Ohio

If Ohio farmers share in the increased acreage as indicated earlier, they will need to plant 890,000 more acres than were planted to corn and soybeans in 1970. Some of this increase might come from rotated grassland, newly cleared land, or shifts to corn and soybeans from oats and other crops. Most of the increase must come from land set aside from corn and wheat production under government programs.

In Ohio during 1970, farmers set aside from feed grain and wheat production about 1,500,000 acres. Almost 1,100,000 acres were diverted in 1970 from feed grain production. With the new feed grain program for 1971, much less total acreage will be diverted.

A CAUTION!

Substantial danger exists that we might expand acreage next year more than indicated or have weather conditions more favorable to higher yields than anticipated. If one or both occur, output could be such that we add to carryover stocks. Such conditions would be accompanied by lower prices. In the next five years, as leaf-blight-resistant varieties are developed, it is doubtful that U.S. agriculture will need to maintain the increased corn acreage to produce the corn needed. Land retirement programs then will likely absorb the acreage.

Soybean acreage in the next 5 years will be influenced by world developments. We must recognize that trade policies in both the U.S. and other countries may become more restrictive, thus reducing our soybean exports. A production response and increasing competition from other oils and meals around the world could be a major constraint on our soybean markets and, in turn, the acreage needed.

CORN PRODUCTION TECHNIQUES

Corn plant populations for Ohio as published in November 1970 by the Crop Reporting Board, ARS, and USDA are as listed in Table 8.

Table 8. OHIO AVERAGE CORN PLANT POPULATION PER ACRE 1967-1970

	1967	1968	1969	1970
Ohio	15,400	17,500	17,700	18,200

In 1970 Ohio farmers finally reached an average-plant population that research indicates should be the minimum for profitable corn production. Plant population, therefore, should be increased on half the corn acreage. There is general agreement that excessively high corn-plant populations should not be recommended for 1971. In Table 9, agronomists suggest combinations of seed drop settings depending on the plant type and cytoplasm. Final stands

Table 9. CORN PLANT POPULATION RECOMMENDATIONS

Type of Hybrid	Normal	Blend	Tms	Final Stand
	Seed Drop in Plants Per Acre			
Low Population	21,000	22,000	23,000	18,000-20,000
High Population	23,000	24,000	25,000	20,000-22,000

recommended for 1971 are 18,000 to 20,000 plants per acre for low-population type hybrid and 20,000 to 22,000 plants per acre for high-population hybrids. It is advisable for farmers to check the percent germination on the seed tag prior to the planting season in order to develop a more accurate planting rate than that presented in Table 9.

TIME OF PLANTING

Ohio agronomists believe that all corn should be planted on time. In the southern half of Ohio, April 15 through May 10 are suggested as planting dates, providing soil conditions are suitable for good seedbed preparation and planting. In the northern half of the state, April 20 through May 20 would be a good range for planting corn. When planting earlier than normal, control depth of seed placement as close to 1½ inches as possible.

NORMAL CYTOPLASM SEED AND BLENDS

Plants from this seed should have the greatest yield potential where corn blight was most serious. In general, use of the most productive soils, a good fertility program, control of weeds, and planting on time will be necessary for efficient production in 1971. Be sure plant population, yield goal, and the fertility programs are in balance. Use Ohio State University soil tests and follow practices for a yield-goal level of 125 to 149 bushels per acre. For low-population type hybrids assume .6-pound ears, and for high population type hybrids assume .5-pound ears. (See Table 80, Page 55, *1970-71 Ohio Agronomy Guide.*)

"T" CYTOPLASM SEED

"T" cytoplasm seed for Ohio should represent about 44 percent of the total supply. Site selection appears to be important for satisfactory performance of T cytoplasm hybrids. If performance was acceptable in 1970, assume the same will be true for 1971. It may be important to cultivate if blight appears in the seedling stage to cover spores formed at the base of the infected plants. Keep this in mind when selecting a tillage program for production with T cytoplasm hybrids.

If the stand is lost from Southern Corn Leaf Blight in the corn seedling stage, the only two crops that could follow in 1971 would be late-planted soybeans or grain sorghum. This is of particular importance in southern Ohio where T cytoplasm corn is to be planted. It must be assumed that a minimum of 3 to 4 weeks would elapse between corn planting and the time that it could be determined that a failure of stand had occurred. The area to be planted to other crops should be thoroughly tilled prior to planting. Little or no weed control in the subsequent crop can be expected from the original application. It is questionable if a herbicide should be applied to the subsequent crop because it could have an additive effect on the second crop.

The following is for your consideration and *should not be considered as recommendations:*

Table 10

	Crops Which May Be Planted Subsequent to Loss of Corn Stand (4 weeks after herbicide application).		
Herbicide Applied to Corn	Soybean	Grain Sorghum	Sudangrass
Atrazine	No	Yes	[2]
Simazine	No	No	[2]
Atrazine and Lorox	No	[1]	[2]
Atrazine and Lasso	No	[1]	[2]
Atrazine and Ramrod	No	Yes	[2]
Atrazine and Sutan	No	[1]	[2]
Sutan	Yes	[1]	[2]
Lasso	Yes	[1]	[2]
Lasso and Lorox	Yes	[1]	[2]
Ramrod	No	Yes	[2]
2,4-D (no more than ½ lb./A)	Yes	Yes	Yes

[1] Some injury may occur.
[2] Susceptibility of Sudangrass to herbicide unknown.

HARVESTING BLIGHTED CORN AND ALTERNATIVE CROPS

BLIGHTED CORN

The degree of success in harvesting blighted corn will vary with the time and degree of plant infestation. That is, if the plants are severely infected before the corn on the ear is in the dent stage, the only satisfactory way to save the crop may be to harvest the corn as whole plant silage. The next most satisfactory method may be to harvest the ears of corn only for corn-cob-mix silage with the combine, or for ground-ear-corn silage using a corn picker.

If the cobs are extremely soft and spongy, the harvesting machines, using stripper plates and blade rolls, should save more of the corn ears than the conventional lug rolls of the corn picker. Lug rolls may pull a soft cob through without snapping it from the stalk. A number of corn picker manufacturers now produce corn pickers with the stripper plate and blade-roll snapping mechanism.

If the corn becomes blight infected during or after the dent stage, it may be possible to save most of the grain by harvesting the crop with a corn picker, picker sheller, or corn combine. Success of this harvesting operation will vary with the condition of the crop and the ability of the machine operator to adjust and operate his machine so as to obtain the least possible loss.

Experience this last harvest season revealed three main problem areas in harvesting blighted corn for grain. They were:

1. **Excessive pre-harvest loss**—ears of corn that had fallen from the stalk before the machine entered the field.
2. **Excessive stalk rot and lodging**—plants broken over due to soft rotten sections in the stalk; whole fields went down in a matter of hours.
3. **Soft, spongy cobs**—the cob structure was weak and pithy, and the kernels were difficult to remove from the cob in the shelling operation.

Keeping a watchful eye on your corn crop so as to note the time and degree of infection and the results developing therefrom, will be a helpful guide in determining how and when to harvest. If blight infections appear frequently on the ear shanks, prepare for a fast, early harvest so as to save those ears before they fall from the stalk.

Check for stalk rot by squeezing the stalk at various places between the ground and the ear. If the stalk is soft and spongy in any section, the stalk is weak and very susceptible to lodging. So, again, plan for a fast, early harvest and concentrate on expert adjustment and operation of the gathering head so as to save lodged stalks.

Removing all the corn kernels from a soft, spongy cob is not easy to do when corn is field shelled at a relatively high moisture content. A suggested practice to keep this cylinder loss to a minimum is as follows:

Start by using recommended cylinder and concave settings for your machine. Then if corn kernels stay on the cob, increase cylinder speed by 50 rpm or close concave-cylinder clearance by 1/16 inch at a time and note the results. The tailings chaffer may also be opened to let cob pieces with kernels fall through to be run through the shelling mechanism once again. This increased shelling action will result in more corn kernel damage and more corn fines so some degree of balance between cylinder loss and corn fines must be maintained. It is recommended that corn fines **NOT** be screened out in the field but that it be done at the storage site so that the amount of fines can be noted and a possible use found for them.

Harvesting losses can be excessive if the operator is not aware of where to look for losses and how to measure them quickly. However, expert machine operators, in corn that is 90 percent standing, should be able to keep losses to about 3 percent of the crop. Corn harvest losses are measured at the rear of the machine. An average of 2 loose kernels per square foot of area represents 1 bushel per acre loss while one ¾-pound ear from 1/100 acre represents about 1 bushel per acre loss. A "Guide for Measuring Corn Harvest Losses" is available from: Extension Agricultural Engineer, 2073 Neil Avenue, Columbus, Ohio 43210.

Other recommendations for expert machine adjustment and operation are given in detail in the following publications:

1. Tips for Peak Corn Harvesting Efficiency—Agricultural Engineering Department.

2. Corn Harvest, Handling and Marketing in Ohio—Extension Service Bulletin 502.

3. A 25-minute, 16 mm color movie on expert corn combine operation entitled "A Hole in the Pocket" will be available from the Extension Film Library after March 1, 1971.

GRAIN SORGHUM

The purpose of any harvesting and threshing operation is to recover the maximum amount of grain, free from foreign material and with a minimum amount of grain damage. Machine adjustments and operating practices greatly effect the *quantity* and the *quality* of the grain harvested. Excessive machine losses will reduce the harvested yield per acre—thus, a reduced profit from the crop. Quality may be reduced by excessive cracking of the grain as well as excessive amounts of stalks and leaves in the grain. This makes the crop more difficult to dry and store, and it may reduce the sale price.

Grain sorghums can be threshed from the heads when the moisture content reaches 30 percent; however, cleaning is difficult at this moisture level. An ideal time for combining is after a killing frost and when the grain moisture is between 18 and 24 percent. For safe storage of grain sorghum, the moisture content must be 13 percent or less. Thus, the sorghum must be dried.

There are two essentials for doing an excellent job of combining. They are 1) knowing where losses may occur and 2) knowing the machine adjustments and operating practices that will keep losses to a minimum. The following "tips" should help you get more quality grain into the grain tank:

1. Proper governed **engine speed** is essential for proper separation and cleaning of the grain. Use a tachometer to set the engine speed according to the recommendations in the operator's manual.

2. **Cylinder speed** will vary with the moisture content of the crop. For machines with 22-inch diameter cylinders, a normal cylinder speed would be between 750 and 900 rpm. If grain moisture is between 25 and 30 percent, then a faster cylinder speed should be used—950 to 1100 rpm. Extra dry sorghum requires a lower cylinder speed—650 to 750 rpm. Refer again to your operator's manual and use the tachometer to verify the cylinder speed. If unthreshed grain is found in the heads, the cylinder speed should be increased by 50-rpm increments until only a few plump grains are found left in the heads. Remember that excessive cylinder speed causes over threshing and increases damage to the seed.

3. **Cylinder-concave clearance** should be set at about ½ inch in front and ⅛ to 3/16 inch at the rear. Decreasing the clearances will increase the threshing action and can cause overloading of the rack and shoe. Generally, increasing the cylinder speed breaks up the stalk material less than does decreasing cylinder-concave clearance. Changes in cylinder-concave clearance should be made in small increments—1/16 inch or less. Then observe the condition of the threshed heads, and the sorghum in the grain tank. Also check for any possible increase in rack and shoe losses due to the increased threshing action.

4. **The chaffer** (upper sieve) should be set ½ to ⅔ open, while the **cleaning sieve** (lower sieve) should be ⅓ to ½ open. Both sieves are normally set level, but under some conditions shoe losses may be reduced by sloping the chaffer and sieve. Make it slightly higher at the rear. The **chaffer extension** may need to be closed to prevent pith pieces of stalk from falling through and going back to be rethreshed. This pith is then reduced in size and goes into the grain tank causing the grain to pick up additional moisture.

5. **Proper wind amount and direction** is essential for clean sorghum in the grain tank and minimum shoe losses. Generally, the amount of air should be greatly reduced over that used for other crops. Use only enough air to keep the material on the chaffer "alive and floating." The main blast of air may be directed to the front portion of the chaffer to permit the grain to pass through quickly while blowing the lighter chaff and straw out the rear of the machine. Have someone catch samples in a bucket of the material discharged from the shoe and rack. Plump sorghum grains should not be *riding* over the rack or shoe, nor should they be *blown* out in the air stream.

6. **Observe the condition and quality of the sorghum in the grain tank.** Clean grain results when the grain sieves are opened properly, the wind is of the correct amount and direction, and the sieves and straw rack are not overloaded. Overloading may be caused by overthreshing at the cylinder or by taking an excessive amount of material into the combine.

7. The **cutter bar** should be raised so as to cut the grain sorghum just below the heads. Cutting lower on the plant increases the amount of material going into the machine; thus, increasing the risk of overloading the rack and shoe.

8. The **reel speed** should be set to run 25 percent faster than ground speed. The reel bats will then "gently" lay the heads back onto the grain platform with a minimum of shattering. A variable reel speed drive makes it possible to adjust the reel speed while "on the go" to match any ground speed.

The **reel height and forward position** should be such that all sorghum heads are moved back on the grain platform. The width of reel bats may be increased by placing hardware cloth between the bats and the reel shaft. This will prevent sorghum heads from "riding over" on the reel and being lost. A hydraulic control for raising and lowering the reel "on the go" helps get more sorghum heads into the combine.

9. Proper **forward speed** is determined by the yield of the crop, the moisture of the grain and the amount of stalk material that must be taken into the machine in order to save the grain. Generally, it's very easy to overload a combine in grain sorghum due to "too much material" on the rack and shoe. Overloading can be reduced by decreasing ground speed or by reducing the width of cut. Gathering unit losses are usually less at a speed of 2.5 to 3 mph so reducing the swath width may be the best way to prevent overloading.

10. Harvest losses in grain sorghum should be about 3 percent of the crop if the harvesting job is done expertly. Losses can be measured using the same procedure as recommended for wheat and soybeans, except that with sorghum about 35 plump grains per square foot of area represents about 1 bushel per acre.

WHEAT

Farmers can reduce harvesting losses when combining wheat by starting as soon as the wheat has dropped to 20 percent moisture content. By starting at 20 percent, harvesting can begin from 5 to 15 days earlier than usual. Also, harvesting may be done more hours each day. There will be about twice as many days when the wheat is between 16 and 20 percent moisture as compared to the number of days it can be harvested at 13 percent grain.

Every day that harvesting is delayed beyond the 20 percent moisture level, losses due to shattering, lodging, birds, and rodents will result in fewer bushels harvested. The problem of secondary weed growth and legumes becomes greater. Test weight of the grain decreases. Harvesting efficiency of the combine decreases.

Research conducted by the Ohio Agricultural Research and Development Center's Department of Agricultural Engineering indicates that as wheat stands in the field after maturity (about 30 percent moisture content):

1. Test weight decreases at the rate of one pound per bushel about every four days.

2. Shatter and related losses decrease the grain available for harvest by one bushel per acre every five days.

Under good harvesting conditions in Central Ohio, it takes five days for the moisture content of wheat on the stalk to drop from 20 to 13½ percent. Under adverse conditions it may require 16 days. Therefore, if you wait until the wheat has reached the 13½ percent moisture level, test weight may be 1 to 4 pounds per bushel less and losses in the standing grain will range from 1 to 3 bushels per acre.

How will the combine function in high moisture wheat?

1. Cutterbar loss is less—about half as much in 20 percent wheat as compared to 13½ percent grain.

2. Cylinder loss increases slightly, but it can be held to less than 1 percent with proper cylinder concave adjustment.

3. Rack loss is lower since overthreshing is less of a problem.

4. Shoe loss is reduced.

Hence with proper combine adjustment and operation, the highest over-all machine efficiency occurs between 15 and 20 percent grain moisture. If wheat is harvested at moisture contents which exceed 20 percent, kernel splitting due to cylinder action may be experienced. Since the split kernels will affect germination, test weight, and storability, there is little to be gained by harvesting wheat above 20 percent grain moisture with a combine.

Before combining wheat above 13½ percent moisture, make arrangements for drying, storing, or selling the high moisture wheat.

Some buyers in Ohio are equipped to dry the wheat and are charging a reasonable rate for drying. In addition to drying cost, grain sold at high moisture content will have a shrinkage discount for the actual loss in weight due to the removal of water, plus a small allowance for losses encountered in handling.

Some grain buyers choose to quote the drying cost and the shrinkage discount separately, while other buyers include both values in one total discount or charge. Some idea of the extent of shrinkage due to moisture removal can be gained from Table 11. For instance, if wheat is dried from 18 to 13½ percent there will be a 5.2 percent reduction in the total weight of grain. To convert the figures in Table 11 to market discount for moisture shrinkage only, multiply the appropriate value from the table by the local market price for 13½ percent wheat. As an example, assume that the market value for 13½ percent wheat is $1.80 per bushel. Then the moisture shrinkage discount for 18 percent wheat would be 5.2 percent of $1.80 or 9.4 cents per bushel. Even though the discount quoted by the local grain buyer may be greater than actual shrinkage and drying charges, a farmer may prefer to sell at high moisture in order to avoid the risks of storage on the farm.

Table 11. PERCENT REDUCTION IN WEIGHT OF WHEAT RESULTING FROM MOISTURE REMOVAL

Moisture Content at Harvest	Moisture Content after Drying					
	14%	13½%	13%	12%	11%	10%
20%	6.9	7.5	8.0	9.1	10.1	11.1
19%	5.8	6.3	6.8	7.9	8.9	10.0
18%	4.6	5.2	5.7	6.8	7.8	8.8
17%	3.4	3.9	4.5	5.6	6.7	7.7
16%	2.3	2.9	3.4	4.5	5.6	6.6
15%	1.1	1.7	2.2	3.4	4.4	4.4

SPELT

Spelt is an unimproved variety of wheat having many characteristics of our present-day wheat varieties except that the hull tends to remain on the spikelet, and there are two grain seeds in a spikelet. Thus, spelt has a test weight of about 40 pounds per bushel as compared to 48 pounds per bushel for barley and 60 pounds per bushel for wheat.

Combine adjustments for harvesting spelt should be similar to those used for wheat except that the upper grain sieve and the lower grain sieve should be opened an additional 1/16 to 1/8 inch to compensate for the larger seed. Wind adjustment may also need to be reduced slightly to prevent grain from being blown over the cleaning shoe, since the spelt seed has less weight than the wheat seed.

The proper moisture for harvesting and storing spelt is similar to that for wheat (See "Wheat" above.)

Strive to operate the gathering head so as to bring all the grain heads into the combine with a **minimum** amount of straw. Taking all the straw into the combine may result in excessive losses over the rack and shoe due to the overloading of these units. If the crop is lodged so that all the straw must be taken into the machine, reduce the width to cut so as to reduce the amount of material on the rack and shoe. Similar results can be obtained by reducing ground speed, but this may cause header losses to increase unless corrective reel adjustments are made. The ideal ground speed is 2.8 to 3.0 mph, and the ideal reel speed is 11 or 12 mph for each mph ground speed.

TRITICALE

Triticale is a cross of rye and wheat and possesses many of the characteristics of rye. So the basic settings for the combine can be made for rye as shown in the operator's manual. The straw length will usually vary between 38 and 44 inches so care should be taken not to overload the rack and shoe by taking in too much straw. Strive to operate the gathering head so as to bring all the grain heads into the machine with a *minimum* amount of straw. If excessive straw causes overloading of the rack and shoe, and the height of cut is not changed, a reduction in swath cut or ground speed will help reduce this overloading.

The moisture for proper harvesting and storing the crop is the same as for wheat or rye. (See "Wheat" above.)

Harvesting losses for an expert operator should not exceed about 2 percent of the crop yield. The test weight of triticale is about 55 pounds per bushel and, for measuring crop losses, an average of 14 triticale seeds per square foot is equal to about 1 bushel per acre.

FEEDING BLIGHTED CORN

CORN FOR RUMINANTS

The organism that causes Southern Corn Leaf Blight apparently does not produce toxins (poisons) that affect ruminants. Blighted corn grain and corn plants may be safely fed to ruminants if the development of secondary molds is prevented. Some of the secondary molds that develop in the field or storage facilities may be toxic. No practical tests for mold toxins are available so farmers must rely on test-feeding techniques that utilize the less valuable animals in a herd or flock. Sheep are more likely to be affected by secondary molds than are beef or dairy cattle.

Blighted corn plants can be made into silage while the plants are still alive and green. Fields of corn that have been killed by Southern Corn Leaf Blight should be harvested as grain crops. Such corn plants do not ensile properly because their high dry-matter content leads to inadequate packing to exclude oxygen, and the reduced sugar content of the plants does not allow sufficient quantities of lactic acid to be produced. Such silage is likely to spoil in storage. If the ensiling process proceeds in a normal fashion, it quickly inhibits the development of molds, and after 14 days no *H. maydis* organisms can be cultured from the silage.

Corn silage made from immature corn will be slightly higher in protein and lower in energy than normal corn silage. The decrease in energy is expected to be somewhat proportional to the reduction in grain present. Additional concentrates should be fed to supply the necessary energy. The reduced consumption of poor quality silage will be more important than the small changes in energy content per pound. Supplemental hay, grass silage, or concentrates will compensate for a reduced intake of poor quality corn silage.

The mineral content of blighted corn silage should not differ significantly from normal corn silage. No special mineral supplements should be needed. As blight progressively kills the green tissues of the corn plant, the carotene, or Vitamin A, potency of the plants is reduced. Rations based primarily on seriously blighted corn silage should provide supplemental Vitamin A.

Blighted corn does not accumulate nitrates (NO_3) in excess of that expected in unblighted corn. Beware of the yellow-orange nitrous oxide gases that may appear in any recently filled silo. Protect yourself, your family and your livestock from these gases. The ensiling process reduces the nitrate content of green chopped corn and can be considered a safety factor in preventing cases of nitrate-poisoning in ruminants.

Urea and/or high-calcium limestone should not be added to blighted green-chopped corn at ensiling time if the dry matter percentage of the green-chopped corn exceeds 35 percent. Both of these additives function as buffers and inactivate lactic acid. In normal corn silage no problem arises because adequate sugar is present to allow enough lactic acid formation to overcome the buffering capacity of the additives. In blighted corn silage inadequate sugar may be present to overcome the buffering capacity of the additives and the silage will be more likely to spoil.

Blighted-corn grain that contains 22 percent or more moisture can be stored as shelled corn in a gas-tight silo or as ground shelled corn or ground ear corn in a conventional silo. The ensiling process will inhibit the further developments of molds but will not destroy toxins already present. Therefore, corn to be stored as high-moisture grain should be harvested before secondary molds develop. Ear corn seriously affected by cob rot should be shelled before being placed in high-moisture storage.

Shelled corn dried to 13 or 14 percent moisture and maintained at less than 15 percent moisture should be safe from further mold development. Drying corn at extremely high temperatures may reduce the digestibility of its protein and starch. This problem is less severe in ruminants than in poultry and swine.

Shelled corn that has a light test weight (48 or 49 pounds per bushel rather than 56 pounds) appears to have a feeding value nearly equal to normal corn when evaluated on a weight basis. The feeds in many commercial operations are measured by volume. When light corn is fed, the weight per scoop, bucket, bag, and dump of automatic feeders should be checked.

Ear corn containing more than 20 percent kernel moisture is likely to mold in a crib if the environmental temperature exceeds 40° F. Such secondary molds may be dangerous to livestock. Prevent the development of these molds if possible. If such molds develop, test-feed the moldy corn to the less valuable animals in the herd or flock. Sheep are more susceptible to mold toxins than are beef and dairy cattle. If ear corn is seriously affected by cob rot, it should be shelled before being blended into concentrate mixtures.

ALTERNATIVE CROPS FOR RUMINANTS

When the corn and soybean meal constants from the 22nd Edition of Morrison's *Feeds and Feeding* are used to compute the monetary value of oats, barley, wheat, spelt, and grain sorghum, only minor differences appear on a per-pound basis. When compared to shelled corn, the higher protein content of most grains approximately replaces the monetary value of the decreased energy content.

Concentrate mixtures that contain more than ⅓ ground oats tend to be light in weight and quite dusty. Spelt should be considered as a replacement for oats in ruminant rations.

Barley may replace half of the corn in concentrate mixtures for ruminants. Further substitution may be made with care. Steam-rolling improves the feeding value of barley.

Wheat is worth 5 percent more than corn on a per-pound basis. Since a hammer mill tends to make flour of wheat, rolling, cracking, or crimping is recommended. Wheat may replace half of the corn in concentrate mixtures for ruminants.

Triticale is a cross between wheat and rye. Only a limited amount of data is available concerning its feeding value. Preliminary data indicate that it is about equal to barley in feeding value. Stem-rolling appears to improve its feeding value.

Grain sorghums have about 95 percent as much feed value per pound as does corn. They should be ground prior to feeding to ruminants. Steam-rolling appears to improve their feeding value. Grain sorghums stored as high-moisture grains appear to be more efficiently utilized by ruminants than the same material stored in a dry form.

Forage sorghums may be used as silage crops. In normal years, they produce a higher yield of green-chopped material and dry matter than does corn. Much of the increased green-chop yield is water and the dry matter is less digestible than that of corn silage. Therefore, a normal crop of corn usually produces a higher yield of T. D. N. per acre. In a year when blight is a serious factor, forage sorghums will probably produce a greater yield of T. D. N. per acre than will corn. Planting forage sorghums for silage, however, removes the opportunity to salvage blighted corn as silage.

Table 12. COMPARISON OF GRAIN SUBSTITUTES FOR CORN IN SWINE GROWING AND FINISHING RATIONS

Grain	Relative Feeding (energy) Value Compared with Corn, Pound for Pound Basis	Maximum Percentage of the Corn it Should Replace in a Typical Corn-Supplement Formula	Preparation	Remarks
Corn	100	100	Ground or shelled	Must be ground if under 15% moisture.
Wheat	100-105	50	Ground and mixed	Wheat-corn mixtures are more efficient than wheat alone.
Oats	60-80	33	Ground and mixed	Highly variable test weights on Ohio produced oats.
Spelt	65-80	25	Ground and mixed	Value influenced by amount of hulls in the feed.
Barley	80-90	50	Ground and mixed	Palatability is reduced by plant diseases. Feeding value varies considerably with test weight.
Milo (grain sorghum)	90-100	100	Whole or ground	If grain is very dry it should be ground. Bird resistant varieties usually should be ground.
				If gains are below normal, increase protein percentage in ration two percentage points.
Rye	90	20	Ground and mixed	Not highly palatable.
Triticale (Canadian originated cross between wheat and rye)	90-100	100	Ground and mixed	Value based on one swine test conducted in Texas. Grain is not generally available for feeding but may be for seed in 1971.

Although grain sorghums may be harvested as silage, to make grain sorghum silage 85 to 90 percent as valuable per ton as corn silage, it must be rolled as it is removed from the silo to crack the grains that the field-chopper missed. Unrolled grain sorghum silage has only about two-thirds of the value of corn silage because many of the grains are not digested.

Silage made from flint corn should be similar in composition to that made from dent corn. Flint corn silage should be harvested in the dough stage and be finely chopped to break most of the kernels.

CORN FOR SWINE

Corn damaged only by Southern Corn Leaf Blight has not been reported to contain toxins harmful to swine. Feeding tests are continuing to be conducted and, to date, do not indicate less feeding value if corn was relatively mature when attacked by the blight. However, corn damaged by this fungus (mold) may be expected to develop other molds in the field and in storage if relatively warm, humid conditions exist. Such corn may need to be aerated in storage to prevent molds which develop particularly in storage from developing.

Young pigs are more susceptible to toxins produced by molds than older, larger hogs, and much more than ruminants. Corn that has mold damage should be fed to hogs of 75 pounds in weight or larger and may be diluted with sound corn in a ground, mixed feed to partially alleviate the usual decreased palatability of moldy corn.

Where all the corn self-fed is moldy, a protein-vitamin supplement should be hand-fed (0.8 pounds per head per day of a 35 percent C.P. supplement, or 0.6 pounds per head per day of a 40 percent C.P. supplement) since, if the supplement is self-fed, the hogs will likely overeat on the supplement. Also, moldy corn can best be fed to market hogs because, depending on the molds present and their stage of growth, toxins present may produce "side" effects such as prominent teats, swollen vulvas, swollen sheaths, as well as rectal and vaginal prolapes which could be especially harmful to pregant females and very young pigs.

Fields containing mature grain, much of which may be moldy and on the ground to the point where it is questionable as to whether or not it will pay to harvest it mechanically, can be hogged off. A group of test hogs in the field for a 7- to 10-day period may be used to determine if this method is safe and if the hogs will eat enough of the corn to be practical.

No one can predict how severe Southern Corn Leaf Blight will be in Ohio in 1971, but—

THESE PRACTICES WILL HELP

- **Order corn seed NOW if you have not already done so.**
- **Plant early—April 15 to May 10 in southern half of Ohio; April 20 to May 20 in northern half.**
- **If you can get all N-cytoplasm seed corn, plant all available land to corn.**
- **Follow cultural practices ordinarily recommended for top corn production.**
- **When using a blend of normal and TMS seed corn, be sure to use pre-emergent weed killers that will not damage soybeans in case you have to disc up corn and plant field to soybeans.**
- **Consider soybeans your best alternate to corn if you are growing the crop for grain. Bird-resistant grain sorghum appears to be best feed grain substitute.**
- **If corn plants are severely infected before corn on ear is in dent stage, harvest crop as whole-plant silage. If corn becomes blight infested during or after dent stage, you may save most of the grain by harvesting with picker, sheller, or combine.**